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TITLE: SEWAGE PURIFYING TANK

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INT-CL (IPC): C02F003/00, B01D065/02 , C02F001/44 , C02F001/52 , C02F003/30
, C02F009/00

ABSTRACT:

PURPOSE: To improve the removal efficiency of nitrogen and phosphorus and to prevent eutrophication by circulating sewage to be treated from a contact aeration tank to an anaerobic filter bed tank and charging phosphorus removing flocculant in the contact aeration tank and arranging a separation membrane module filtering sewage to be treated.

CONSTITUTION: Raw water is supplied to a first anaerobic filter bed chamber 1 and successively transferred to a second anaerobic filter bed chamber 2 and a contact aeration tank 3 to be subjected to purifying treatment. The raw water is subjected to aerobic treatment in the contact aeration tank 3 by air to subject a nitrogen component to nitration treatment. The treated water is sent to the anaerobic filter bed tank to be subjected to reductive denitrification

treatment to efficiently perform the removal of nitrogen. A phosphorus
removing flocculant 6 is charged in the contact aeration tank 3 and phosphorus
in raw water is flocculated as flocs to be removed. The phosphorus removing
flocculant 6 is also charged in the anaerobic filter bed tank along with a
nitrating solution to flocculate and remove a phosphorus component. The formed
flocs are transferred to the contact aeration tank 3 and filtered by a membrane
to be prevented from flowing out.

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Abstract Text - FPAR (1):
PURPOSE: To improve the removal efficiency of nitrogen and phosphorus and to
prevent eutrophication by circulating sewage to be treated from a contact
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International Classification, Secondary - IPCX (4):
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(33)優先権主張国　日本（ＪＰ）

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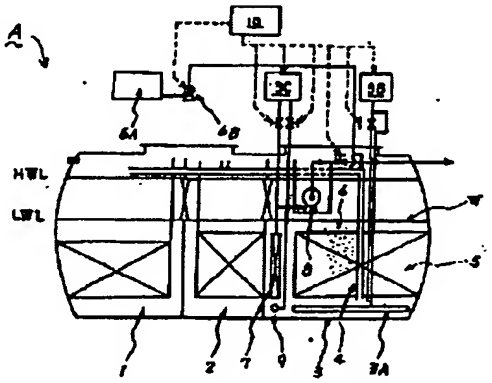
(54)【発明の名称】　汚水浄化槽

(57)【要約】

〔目的〕　分離膜モジュールを備えた汚水浄化槽において燐の除去効率を改良し排出水による富栄養化を防止すると共に浄化槽の小型化を達成する。

〔構成〕　嫌気ろ床槽第一室、同第二室及び接触ばっ気槽を備えた汚水浄化槽において、接触ばっ気槽より処理汚水を常時又は間欠的に前記嫌気ろ床槽第一室又は同第二室へ循環返送するポンプ装置が設けられ、前記接触ばっ気槽内には接触材が配置されると共に燐除去用凝集剤が投入され、さらに該接触ばっ気槽内には処理汚水を濾過する分離膜モジュールが配設され、該分離膜モジュールには吸引ポンプが接続されていると共に、逆洗用空気供給装置が接続されてなり、燐除去用凝集剤により燐を除去すると共に分離膜モジュールの吸引時の目詰まりを有効に防止する。



A－汚水浄化槽
1－嫌気ろ床槽第一室
2－嫌気ろ床槽第二室
3－接触ばっ気槽
4－循環ポンプ装置
5－接触材
6－リン除去用凝集剤
7－分離膜モジュール
8－吸引ポンプ
9－逆洗用空気供給装置

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【特許請求の範囲】

【請求項1】　嫌気ろ床槽第一室、同第二室及び接触ばっ気槽を備えた汚水浄化槽において、接触ばっ気槽より処理汚水を常時又は間欠的に前記嫌気ろ床槽第一室又は同第二室へ循環返送するポンプ装置が設けられ、前記接触ばっ気槽内には接触材が配置されると共に燐除去用凝集剤が投入され、さらに該接触ばっ気槽内には処理汚水を濾過する分離膜モジュールが配設され、該分離膜モジュールには吸引ポンプが接続されていると共に、逆洗用空気供給装置が接続されてなることを特徴とする汚水浄化槽。

【発明の詳細な説明】

【0001】

【産業上の利用分野】この発明は汚水浄化槽に関する。

【0002】

【従来の技術】従来、汚水浄化槽として嫌気ろ床第一室、同第二室、接触ばっ気槽、沈殿槽及び消毒槽を備え、処理汚水を順次上記各槽に移流させつつ浄化処理していく汚水浄化槽が知られている。上記汚水浄化槽は、主としてBODの除去には効果があるが、窒素、燐成分の除去は殆ど効果がなく、処理排水による富栄養化の防止効果が充分でなく、また排出汚水に微細浮遊物が残留する欠点があった。

【0003】このような窒素、燐成分の除去として、前者については接触ばっ気槽での硝化（酸化）処理液を前段処理槽である嫌気処理槽へ循環返送し還元させて脱窒を行なうことが知られている（「用水と廃水」Vol 30. No.5(1988) P462 ～470）。後者の燐については凝集沈殿法や凝集砂濾過法が知られている（同上）。

【0004】

【従来技術の問題点】しかしながら、上記処理手段の内、燐の除去における凝集沈殿法や凝集砂濾過法を実施するには沈殿槽や砂濾過槽が必要となり、家庭用等小型の汚水浄化槽としてはスペース、コストの面でかなり不利とならざるを得ない欠点があった。また、汚水処理の最終段階としてセラミックメンブレン、あるいはガラス又はプラスチック製0.1 ～60μm 目開きの微細多孔質管よりなる分離膜モジュールを使用し嫌気、好気処理後の処理汚水を濾過して排出する汚水浄化槽も提案されているが、汚水浄化効率の良い高濃度活性汚泥処理等と併用した場合濾過抵抗により分離膜モジュールのフラックスが小さくなり濾過面積を大きくとる必要上装置のコンパクト化が困難となり、また頻繁に逆洗を実施する必要も生じて維持管理が面倒となる欠点があった。

【0005】

【発明が解決しようとする課題】この発明は上記問題点に鑑み、BOD改良は勿論のこと窒素及び燐の除去効率が良く、排出水による富栄養化防止の達成ができ、かつ小型化も達成可能な汚水浄化槽を得ることを目的としてなされたものである。

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【0006】

【課題を解決するための手段】即ち、この発明の汚水浄化槽は、嫌気ろ床槽第一室、同第二室及び接触ばっ気槽を備えた汚水浄化槽において、接触ばっ気槽より処理汚水を常時又は間欠的に前記嫌気ろ床槽第一室又は同第二室へ循環返送するポンプ装置が設けられ、前記接触ばっ気槽内には接触材が配置されると共に燐除去用凝集剤が投入され、さらに該接触ばっ気槽内には処理汚水を濾過する分離膜モジュールが配設され、該分離膜モジュールには吸引ポンプが接続されていると共に逆洗用空気供給装置が接続されてなることを特徴とするものである。

【0007】

【実施例】次にこの発明の実施例を説明する。図1はこの発明の実施例の断面図である。この発明の汚水浄化槽Aは、嫌気ろ床槽第一室1、同第二室2及び接触ばっ気槽3を備えた汚水浄化槽Aにおいて、接触ばっ気槽3より処理汚水を常時前記嫌気ろ床槽第一室1又は同第二室2（図示例は嫌気ろ床槽第一室1）へ循環返送するエアリフトポンプ等のポンプ装置4が設けられ、接触ばっ気槽3内にはハニカム構造のばっ気接触材5が配置されると共にポリ塩化アルミニウム（PAC）等の燐除去用凝集剤6が投入され、さらに接触ばっ気槽3内には処理汚水Wを濾過するセラミックメンブレン、あるいはガラス又はプラスチック製0.1～60μm （好ましくは0.1 ～10μm ）目開きの微細多孔質管よりなる分離膜モジュール7が配設され、分離膜モジュール7には吸引ポンプ8が接続されていると共に逆洗用空気供給装置9が接続されて構成されている。

【0008】上記実施例において逆洗用空気供給装置9は接触ばっ気槽3の散気管3Aに空気を供給するエアブロワ3Bを兼用しても良いが、図示のように別系統のエアブロワ3Cを設けることが望ましい。また図中10は逆洗時期をコントロールする制御装置を示し、汚水発生の少ない時間帯を選び、一週間前後の期間毎に分離膜モジュール7の逆洗を自動的に行なうために設けられる。

【0009】また図中6Aは接触ばっ気槽3へ投入される燐除去用凝集剤6の供給タンクを示し、燐除去用凝集剤6は制御装置10の制御によりポンプ6Bにより供給タンク6Aから自動的に、かつ定期的に供給される。

【0010】

【作用】この発明の汚水浄化槽Aにおいて、汚水原水は嫌気ろ床槽第一室1へ供給され、順次嫌気ろ床槽第二室2、接触ばっ気槽3へと移流させつつ浄化処理していく。接触ばっ気槽3においては散気管3Aより噴出する空気により好気処理され、汚水中に含まれる窒素分は硝化処理される。

【0011】また、この処理水は常時又は間欠的にエアリフトポンプ等のポンプ装置4により嫌気ろ床槽第一室1へ返送され、この処理槽での還元により脱窒が行なわれ、効率良く窒素除去が行なわれる。また、接触ばっ気

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槽3内には燐除去用凝集剤6が投入されているため、これによって汚水中の燐がフロックとして凝集され除去される。また、接触ばっ気槽3は、ばっ気接触材5により汚水の処理を行う構成であるため浮遊汚泥の発生が少なく、その分分離膜モジュール7の目詰まりが少なく、逆洗頻度が低くされる。

【0012】また、燐除去用凝集剤6はポンプ装置4により硝化液と共に嫌気ろ床槽第一室1へも挿入される。従ってこの嫌気ろ床槽第一室1内においてもやがては燐成分が凝集され除去される。凝集フロックは、接触ばっ気へ移流しても膜ろ過で流出が防止される。また循環式の嫌気ろ床槽の通水部は半好気状態なので汚泥内リンの溶出が少ない。また、フロック化した燐成分は定期的な浄化槽の清掃時に汚水浄化槽外へ取り出される。以上の汚水処理の結果、分離膜モジュール7より濾過排出された処理水の燐含有量は1ppm 以下、窒素含有量6ppm 以下、BODは5ppm 以下とされる。なお、接触ばっ気槽3で発生した分離膜モジュール7に付着した汚泥は制御装置10の制御により実施される定期的な逆洗により除去され同時にポンプ装置4により嫌気ろ床槽第一室1又は別途汚泥貯留槽へ返送される。

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【0013】

【発明の効果】以上説明したように、この発明の汚水浄化槽は接触ばっ気槽で硝化された処理水を嫌気処理槽へ返送することにより脱窒を効率良く行なうと共に、燐除去用凝集剤によって燐を凝集除去するので従来の汚水浄化槽に比し窒素、燐の除去が非常に良く行なえ、汚水による富栄養化防止が図れ、このため非常に透明度の有る排出水を得ることができるのである。

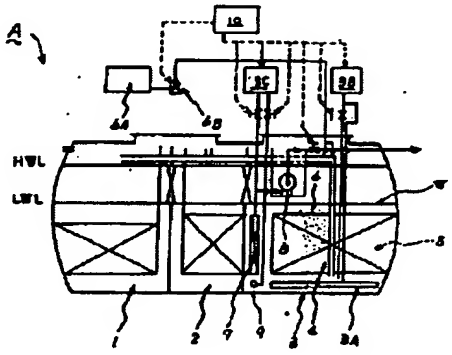
【図面の簡単な説明】

【図1】この発明の実施例の断面図である。

【符号の説明】

A	汚水浄化槽
1	嫌気ろ床槽第一室
2	嫌気ろ床槽第二室
3	接触ばっ気槽
4	返送ポンプ装置
5	接触材
6	リン除去用凝集剤
7	分離膜モジュール
8	吸引ポンプ
9	逆洗用空気供給装置

【図1】



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1…嫌気ろ床槽第一室
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3…接触ばっ気槽
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5…接触材
6…リン除去用凝集剤
7…分離膜モジュール
8…吸引ポンプ
9…逆洗用空気供給装置

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do hereby certify that I am well acquainted with the Japanese and English languages and that the attached is an accurate translation of Japanese Patent No. JP 4215892.

Signature of Translator: K Yoshida

Date: 12/13/04

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SEWAGE PURIFYING TANK

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(54) Title of Invention: Sewage Purifying Tank

(57) Abstract
Purpose: To improve the rate of phosphorus removal thereby preventing eutrophication of the discharged water and to achieve compact size of the tank, in a sewage purifying tank with separation membrane module.

Constitution: In a sewage purification tank with an anaerobic filter bed chamber, a second anaerobic filter bed chamber and a contact aeration tank, a pumping device is implemented to circulate the treated water in the contact aeration tank back to either the first or second anaerobic filter bed chamber. The contact aeration tank is equipped with a contact apparatus and a phosphorus removing flocculant agent is injected into the tank. The contact aeration tank is also equipped with a separation membrane module to filter the treated water and the separation membrane module is further linked with a suction pump and an air supply device for reverse cleaning, which enables the tank to remove phosphorus by the phosphorus removing flocculant agent and also to efficiently prevent clogging of the separation membrane module.

Scope of Claim
Claim 1: Sewage purification tank comprising an anaerobic filter bed chamber, a second anaerobic filter bed chamber and a contact aeration tank, with a pumping device implemented to circulate the treated water in the contact aeration tank back to either the first or second anaerobic filter bed chamber. The said contact aeration tank is equipped with contact aeration apparatus and a phosphorus removing flocculant agent is injected into the tank. The contact aeration tank is also equipped with a separation membrane module to filter the treated water and the separation membrane module is further linked with a suction pump and an air supply device for reverse cleaning.

Detailed Explanation of the Invention
(0001)
Field of Industry Application: This invention concerns sewage purification tank.

(0002)
Current Technology: Currently known sewage purification tanks successively transfers the raw water from first anaerobic filter bed tank to second anaerobic filter bed tank and then to a contact aeration tank, which comprise the sewage purification tank. This sewage purification tank is effective in removing mainly BOD but ineffective in removing nitrogen and phosphorus components and therefore inadaquate to prevent eutrophication of the treated water. Another drawback is that suspended solid residues remain in the treated water.

(0003)
For removal of nitrogen and phosphorus components, nitrogen is known to be treated by circulating the water treated with nitration (oxidation) in the contact aeration tank back to the previous treatment tank, namely the anaerobic tank, for reduction and nitrogen removal. ("City Water and Sewage" Vol. 30, No. 5(1988) p462-470) For the latter

phosphorus treatment, flocculation sedimentation method and flocculation sand filter method are known. (Ibid.)

(0004)
Problem with the Current Technology: In order to achieve the removal of phosphorus by either flocculation sedimentation method or flocculation sand filtration method, the required sedimentation or sand filtration tanks are very unfavorable in terms of space and cost, for compact applications of sewage purification tank such as for homes. There have been proposals of sewage purification tanks that employ ceramic membrane or separation membrane module consisting either glass or plastic micro hollow-fibers with pore sizes of .1 – 60 μm, to filter the treated water after the anaerobic and aerobic filter bed tanks, as the last phase of the treatment. This method, however, had drawbacks when used in conjunction with highly efficient sewage purifying method such as high-density activated sludge processing in that it requires a larger filtering area to counter the small flux of the separation module caused by filter resistance, which renders the apparatus difficult to be compact in size. The necessary frequent reverse cleaning also made the maintenance management taxing.

(0005)
Problems That This Invention Attempts to Solve: The objective of this invention is to address the aforementioned problems by achieving a sewage purifying tank that efficiently removes nitrogen and phosphorus as well as BOD, accomplishing the prevention of eutrophication of the treated water and also realizing a compact size.

(0006)
Problem Solving Measures: The sewage purification tank in this invention comprises an anaerobic filter bed chamber, a second anaerobic filter bed chamber and a contact aeration tank, with a pumping device implemented to circulate the treated water in the contact aeration tank back to either the first or second anaerobic filter bed chamber. The said contact aeration tank is equipped with a contact aeration apparatus and a phosphorus removing flocculant agent is injected into the tank. The contact aeration tank is also equipped with a separation membrane module to filter the treated water and the separation membrane module is further fitted with a suction pump and an air supply device for reverse cleaning.

(0007)
Embodiment of the Invention: An example of the invention's implementation is described as follows. Figure 1 shows the cross-section of an example of the implemented invention. The sewage purifying tank A of this invention is comprising first anaerobic filter bed chamber 1, second anaerobic filter bed chamber 2 and a contact aeration tank 3, with a pumping device 4 employed to circulate the treated water in the contact aeration tank back to either the first or second anaerobic filter bed chamber (example figure shows circulation to anaerobic filter bed chamber 1). The said contact aeration tank 3 is equipped with a honeycomb structure contact apparatus 5 and a phosphorus removing flocculant agent 6 such as polyaluminum chloride(PAC) is injected into the tank. The contact aeration tank 3 is also equipped with a separation membrane module 7 consisting

of ceramic membrane or micro hollow-fibers made of either glass or plastic with pore sizes of .1 – 60 μm (preferably .1 – 10 μm) to filter the treated water W, and the separation membrane module 7 is further fitted with a suction pump 8 and an air supply device 9 for reverse cleaning.

(0008)
In the example above the reverse cleaning air supply device 9 can also be used as air blower 3B to supply air to air diffuser 3A in the contact aeration tank 3, however, a separate air blower 3C as shown in the figure is preferable. In the figure, 10 is the control device to regulate reverse cleaning timing, which automatically conducts reverse cleaning of the separation membrane module 7 during the hours when the least sewage is generated, in approximately one week period frequency.

(0009)
Also in the figure, 6A is the supply tank of the phosphorus removal flocculant agent 6 which is injected into the contact aeration tank 3. The phosphorus removal flocculant agent 6 is supplied automatically and constantly by pump 6B from supply tank 6A, which is regulated by the controlling device 10.

(0010)
Operation: In the sewage purifying tank A of this invention, raw sewage water is supplied to the first anaerobic filter bed chamber 1 and transferred to the second anaerobic filter bed chamber 2 and then to contact aeration tank 3, and successively treated for purification. In the contact aeration tank 3 the water is aerated by the air diffuser 3A and the nitrogen component in the sewage is nitrated.

(0011)
This treated water is constantly or intermittently circulated back to the first anaerobic filter bed chamber 1 by pumping device 4, the nitrogen component is treated for reduction in this chamber and nitrogen is effectively removed. In the contact aeration tank 3 the phosphorus removing flocculant agent 6 is injected, and the phosphorus component in the sewage water is removed as flocs. Since the contact aeration tank 3 comprises the aeration contact device 5 to treat the sewage, less suspended sludge is generated, which results in less clogging of the separation membrane module 7 and less frequency of reverse cleaning.

(0012)
The phosphorus removing flocculant agent 6 is also introduced to the first anaerobic filter bed chamber 1 by pumping device 4 along with nitration agent. Consequently the phosphorus component is flocculated and removed also in the first anaerobic filter bed chamber 1 in due time. The flocculated flocs are prevented from draining by the membrane filter even if displaced into the contact aeration tank. Since the water passage section of the circulating anaerobic filter bed chamber is in semi-aerobic condition, there is less seeping of phosphorus in the sludge. The flocculated phosphorus component is discarded outside the sewage purifying tank during regular cleaning of the tank. The results of above sewage purification treatment is that the treated water is filtered and

discharged from the separation membrane module 7 with 1ppm or less phosphorus content, 5ppm or less nitrogen content and 5ppm or less BOD. Sludge generated in the contact aeration tank 3 and adhered to the separation membrane module 7 is removed by periodical reverse cleaning which is regulated by the control unit 10, and simultaneously circulated to the first anaerobic filter bed chamber 1 by pumping device 4 or sent to a sludge storage tank separately.

(0013)
Effect of Invention: As described above, the sewage purifying tank of this invention provides efficient removal of nitrogen by circulating the treated and nitrated water in the contact aeration tank back to the anaerobic treatment tank, and also provides removal of flocculated phosphorus by a phosphorus removing flocculant agent. As a result the removal of both nitrogen and phosphorus is highly efficient and improved compared to the current sewage purifying tanks, and the eutrophication of the sewage is prevented thus delivering discharged water with very high clarity.

Brief Explanation of the Figure
Figure 1: Cross-section of an example of implemented invention.

Symbols:
A Sewage purifying tank
1 First anaerobic filter bed chamber
2 Second anaerobic filter bed chamber
3 Contact aeration tank
4 Circulation pumping device
5 Contact apparatus
6 Phosphorus removing flocculant agent
7 Separation membrane module
8 Suction pump
9 Reverse cleaning air supply device